THE GLASS INDUSTRY

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Concerning the International Glass Situation

FACING a Postwar World drawn closer together by transportation miracles, our glass industry must take stock of its international relationships. It is true that glass, like bread and milk, in most instances is a local affair. But even before the War, 15 per cent of the world's production passed through foreign trade channels and glass was an important export and import product to several nations.

The United States is currently producing more glass than the rest of the world combined, whereas before the war it accounted for only one-third of the total. This increase in ratio has been due to expanded output here and to decreased production abroad. It is true that the maintenance of this leading position after the War will depend on a number of factors, including patent arrangements and the industry's ability to develop technological research programs; but the purely trade matters which must be considered involve the extent of foreign competition in the domestic market caused by glass imports, the volume of our glass sales to foreign markets through exports, and the degree to which American glassmen participate in the development of new glass industries abroad, particularly in Latin America.

Opinions vary as to the probable nature or volume of our import glass trade after the war. However, one fact seems certain: *glass will be considered in any tariff deals we make with those nations which have exported it in large quantities to the United States in the past.* This fact must be faced and American manufacturers must study and plan now to meet the situation. It is doubtful that much can be accomplished by simply "pressuring" against tariff changes — too many fundamentals will be at stake. Each branch of the industry must review its relationship to the national economy as a whole and be judged on the merits of its case. While all types of glass products were imported before the war, foreign handmade tableware and window glass were probably the most bothersome, supplying perhaps 20 per cent and 10 per cent respectively of the market. This participation was great enough to create a price problem to American producers who faced a weekly wage bill greatly in excess of that paid by competing producers abroad. A leading question our glassmen will no doubt pose will involve the actual benefits foreign countries receive from United States tariff reductions which in some instances, at least, have brought greater returns to importers in this country than to the supplying countries abroad.

While official export statistics have not been released since 1940, trade sources report a sizable expansion of our foreign sales of glass during the war. This export trade must now embrace a substantial volume since in 1940 it approached $15,000,000. Certainly a good portion of the current foreign sales must be classified as "war business" but glassmen will not give up these new markets without a fight. Careful study should be given ways and means of holding a large portion of this business and of increasing our share of the increased potentials of such markets as Latin America and South Africa in the Postwar Glass World.

Closely linked with the export situation is the establishment and expansion of glass production in countries which formerly imported their requirements. Such developments should be of real concern to our glass industry particularly when they involve Latin American countries where industrial developments are important from the political angle. Such projects cannot be carried on without aid of some sort from older glass producing nations and those Latin American plants which are economically feasible and inevitable should be aided by our capital, technical skill and equipment. There are already too many glass factories in Latin America utilizing capital, equipment, skill and management counsel imported from outside of the Western Hemisphere.

The glass industry should have no fears from the international angle in the Postwar World—we produce the best and the most. But that does not mean we can rest on our oars—we must study and plan now.

GLASS DIVISION MEETING IN UNIONTOWN BREAKS ATTENDANCE RECORD

The Glass Division of the American Ceramic Society had itself a high time at Summit Hotel, four miles east of Uniontown, Pa., plus six per cent up. High attendance (147), high interest, a high quality of papers and discussions, and a high degree of good fellowship with our own division members and also with those of the White Ware and Materials and Equipment divisions who were good enough to come early for their own meeting. Some came in upper berths, by way of consistent preparation.

In spite of the preoccupation of many laboratories with the war effort, Program Chairman K. C. Lyon of Armstrong Cork Co. succeeded in crowding the two half-day sessions, Sept. 15 and 16, with interesting material. Cooperation by Pittsburgh Plate Glass Co., B. F. Drakenfeld & Co., Owens-Corning Fiberglas Corporation and Washington Stencil Products Co. provided flat-glass badges, decorated with the Society emblem and Division lettering, with a simulated etched area of applied color for names, and a puncture for lapel attachment by means of a narrow glass ribbon.

Mr. Lyon considerately placed his own paper first on the program. He succeeded in demonstrating that surface tension of glasses is another property that is sufficiently proportional to the weight per cent of the various oxides that it can be estimated with fair accuracy by the use of proportionality factors for each oxide. That is, the effect of each oxide in the glass is additive, as accurately as it can be said to be additive for any of the physical properties commonly estimated in this manner. The data obtained by a number of experimenters were reviewed and employed as a basis for deriving factors. These factors came out, of course definitely in line with the qualitative effects of the various oxides on surface tension previously reported. The speaker made the interesting confession that calculation of factors by algebra, using the standard equation expressing the additive theory, produces too much scattering of values; something like a "cut-and-try" process had to be employed.

A departure from any usual approach to the problem of improving glasshouse refractories appeared in a paper by A. E. Badger (Univ. of Ill.) and C. J. Uhrmann and A. C. Ottoson (Imperial Glass Co.). In view of the effects of surface tension on producing upward drilling and flux-line attack of glass on clay, the theory followed was that the inclusion of an oxide that would appropriately lower the surface tension of the glass-refractory solution would quiet these local disturbances. If this fact can be practically demonstrated, the paradoxical result will be that the inclusion of an actual flux in a refractory wall against glass will retard corrosion.

Mellen A. Knight, of the Preston Laboratories, was slated to give a paper on "Nickel Silicates in Glass." His place was taken by Dr. Frank W. Preston, who explained that the work was still in progress and not ready for formal presentation. Nevertheless, Dr. Preston reported the main finding of interest, which is that nickel may readily form a double silicate with calcium, just as magnesium does in diopside. In glasses containing fairly large contents or local segregations of nickel, crystals may form that are petrographically identical with diopside ($CaO.MgO.2SiO_2$), but dark, lacking in magnesium, and apparently a "nickel diopside," in which the Ni atom, of nearly the same size, goes in for the Mg atom.

Earlier, Dr. Preston took the floor to reminisce about the first Fall Meeting of the Division, 1929, at the Flint cottage at Cove Point, Maryland, and how he rode in Francis Flint's car, and how, as they drove over Summit Mt. in the misty morning, a startled deer almost interrupted their progress and barely escaped from the slippery road. The narrative was really intended, on the whole, to praise Mr. Flint's organizing ability and to call attention to the growth of the Fall Meeting idea. Called up to take a bow, the modest Mr. Flint covered his embarrassment by remarking that, "Here is one of Preston's big-game stories that can be verified."

We were told that there is plenty of soda ash and other bulk materials for glass; that niter is very short, so far as glassmaking is concerned, and that we can't have arsenic; that oil must be economized by using natural gas, although gas will be so tight in the winter that glassmakers ought to begin using producers, whereas coal for producers will be very hard to get. All of this must not be published, perhaps because everyone knows it anyhow.

"Electronics in the Glass Industry," by H. C. Steiner,

Photos by E. L. Hen

General Electric Company, was an illustrated paper devoted chiefly to demonstrating how useful the "electric eye" may be in performing automatic operations in the industry. This might have been more interesting, if something about the part played by glass in making the necessary apparatus for sending and receiving electrons had been emphasized.

The several types of checker brick, with their desirable properties and advantages in performance, were set forth by C. A. Brashares, Harbison-Walker Refractories Co. He dwelt particularly upon the forsterite (high magnesia) brick, lately brought into service.

Committee C-14, the glass department of the American Society of Testing Materials, held brief sessions of its advisory committee, and of Sub-Committees III and VII. Publication, in bound form, of tentative standards was approved. These sub-committees completed organization of personnel.

In the evening, after enjoying one of the excellent dinners for which the hotel is famous, the members were entertained by professional dancing and singing in the night club. The singing, both solo and group, was of course of a high order.

The general subject of the following morning's session was batch. Mr. H. J. Hunt, Kimble Glass Co., led off with an account of methods of sampling, analyzing, and estimating batch from the point of view of homogeneity or adequate mixing. He showed a clever plan for adapting a sieve test to the estimation of cullet, when this is ground and mixed with the batch.

Mr. F. A. Fix, Lancaster Iron Works, Inc., gave a neat demonstration of the way in which the Lancaster Mixer operates. A four-foot wooden model, on edge, complete with motor and lighting, performed admirably, and furnished a convincing accompaniment to Mr. Fix's talk.

Regrettably, representatives of two other firms were unable to be present to argue the merits of their respective machines.

A series of slides exhibited by O. G. Burch, Owens-Illinois, recounted all too briefly an immense amount of work that has been done in his laboratory on the melting behavior of various batches as related to ingredients and grain-size, with special reference to the time required for batch to become sand-free. Publication of the data will be awaited with much interest.

For this symposium on batch, Glass Division Chairman J. F. Greene, Kimble Glass Company, left the speaker's table in charge of S. R. Scholes, New York State College of Ceramics.

During the afternoon, V. V. Kelsey and General Secretary R. C. Purdy called a meeting of the publicity committee to consider ways and means of combating the pernicious Kilgore bill providing for governmental control of research, and to consider how "ceramics" may be brought into the common speech and writing of the people in a more technical and definite usage.

The morning mist and rain having ceased, the golf tournament was held on the mountain-top course. R. Hummel, Harshaw Chemical Co., won the O. Hommel Trophy with a low gross of 88. The sweepstakes handicap resulted: R. M. Curts, American Potash & Chemical Co., and H. E. Simpson, Mellon Institute, tied for low net, 68, with A. B. Scholes, Sylvania Electric Products, Inc., third at 70.

There were 23 entries.

Treischel of R. T. Vanderbilt Co. acted as starter and scorer for the event.

SUMMARIES OF TECHNICAL PAPERS

The Calculation of Surface Tensions of Glasses. *By K. C. Lyon, Armstrong Cork Company.*

Additive factors for the calculation of glass properties such as thermal expansion, density, refractive index, dispersion, viscosity and others have been developed by various investigators. The importance of surface tension in glassmaking processes plus the fact that the recent literature contains numerous data on the surface tension of glasses of various composition led the author to derive a set of factors for the calculation of surface tension from the glass composition.

Seventy-five glasses which have been reported in the literature were subjected to a mathematical analysis from which the factors given in Table I were derived. A comparison of these factors with those previously given by Dietzel shows good agreement for Na_2O, K_2O, and B_2O_3, while the agreement for Al_2O_3 and Fe_2O_3 was fair. In the case of the value for silica the author believes that his value is more nearly correct (this belief being based upon data obtained on the influence of surface tension on cord formation). The differences in values for CaO and MgO can be explained in terms of their dependence upon the silica value. In addition, the order of magnitude of these new factors seems to be correct. The SO_3 value being based upon numerous assumptions must be considered as being only approximate. For practical purposes, however, its value may be taken as zero in the case of ordinary glasses which contain only fractional percentages of SO_3.

Graphs were also given which showed the differences between the values of surface tensions reported for the glasses used and the values calculated by the use of the derived factors. Values computed by means of these factors may be considered to be accurate within 5 dynes per cm. and are probably accurate to within 3 dynes per centimeter of the correct value.

TABLE I.

The Effect of 1 *Per Cent Oxide Upon the Surface Tension of Glass in Which the Ratio SiO_2:Na_2O Exceeds* 3.25

	Dynes per Cm.	
Oxide	1200°C	1400°C
SiO_2	3.25	3.24
Fe_2O_3	(4.5)*	(4.4)
Al_2O_3	6.12	5.84
B_2O_3	0.32	0.00
CaO	4.92	4.90
MgO	5.96	5.77
BaO	(3.77)	(3.80)
Na_2O	1.28	1.12
K_2O	(0.00)	(—0.85)
SO_3	(—0.12)	(—0.11)

*Values in parentheses are intended to be indicative of order of magnitude only. They are present in significant amounts in very few of the glasses treated.

The Use of Lead Oxide in Glassmaking Refractories. *By A. E. Badger, C. J. Uhrmann and A. C. Ottoson.*

Recent work has indicated that surface tension plays an important role in the production of cord free glass. It has been shown that cords which have a surface tension greater than the surrounding glass tend to persist as cords, while cords which have a lower surface tension than the surrounding glass tend to dissolve in the glass and disappear. It has also been found that certain oxides when added to a soda-lime-silica glass produce a marked lowering of the surface tension of the resulting glass.

As refractory cords are extremely common, the authors have attempted to develop a refractory body which will pro-

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GAS PRODUCERS CAN HELP SOLVE NATURAL GAS SHORTAGE

By ROBERT F. FERGUSON[1]

With serious curtailment of natural gas supplies impending no possibility of conserving this fuel must be overlooked. Approximately seventy per cent of the glass factories in the United States depend on natural gas as their major fuel. Many of these plants, now using natural gas, formerly operated on producer gas, and, in some of them, the producers are still standing in greater or less state of disrepair. Even though extensive repairs are necessary, it is still possible that many installations can be put into operation with less critical material than would be required by any other conversion. In fact, any other conversion, such as to fuel oil or to butane, would be going from bad to worse, insofar as availability of fuel is concerned.

An obstacle in some cases will be the regenerators. Even where the producers have been left in place, the furnaces have sometimes been rebuilt with no provision made for gas regenerators. This was, of course, good economy at the time, because it made possible more air regeneration and eliminated the troublesome dividing wall in the regenerator chamber. It will be necessary to reinstall the gas regenerators and the requisite flue systems before producer gas can be used.

Granted that the gas producers can be put in repair; that the regenerators and flues have been designed for producer gas; and that coal can be obtained, and, finally, provided that steam is available, then there is no reason why the glass cannot be melted with producer gas, and the natural gas conserved for the lehrs, for the feeders, for heating up new tanks, and for holding temperature over shutdowns.

There is a slight tendency to regard gas producers as coeval with the bustle and as justly obsolete. A recent survey[2] of the present status of the industrial gas producer made by Battelle Memorial Institute for Bituminous Coal Research, Inc., showed that the mechanically operated producers now available, when properly instrumented, are dependable machines that convert coal into gas at very nearly the maximum efficiency possible for the process.

An indication of the interest in the subject of producer gas in the United States and abroad during recent years is shown in Table 1, which gives the count of the technical articles listed in *Engineering Index*, under the heading "Gas Producers and Producer Gas."

TABLE I

Number of Articles on Producer Gas Indexed, in "Engineering Index," 1926-1940

Year	United States	Great Britain	Germany	France	Other Foreign	Total
1926	8	5	4	0	2	19
1928	9	5	6	1	2	23
1930	19	8	7	2	3	39
1932	1	1	8	1	2	14
1934	4	4	6	3	0	17
1936	2	2	6	2	5	17
1938	1	3	11	1	1	17
1940	0	19	5	3	8	35

After reaching a high mark in 1930, the interest in producers in the United States dropped to a low level in the following years. This was coincident with the construction of the long-distance natural gas pipe lines, and the rise in the use of fuel oil. Such a tapering off of technical publications can usually be interpreted as indicating that knowledge of the subject has advanced to such a high level that discovery is impossible, until some entirely new phase develops.[3]

The increase in the number of journal articles in Great Britain in 1940, is accounted for by the interest in producers for automotive vehicles. Practically all of these articles deal with small mobile units. However interesting these might be to the holders of "A" books, they will be of little help to the glass maker.

So, in spite of the fact that no major changes have been made in gas producers in the last ten years, they may still be regarded as entirely modern engineering equipment. Gas producers were displaced in the principal glass producing regions in the Middle West, simply by the fact that natural gas could be purchased more cheaply. The following figures are based on a study made in 1935,[4] and changes since then will not be sufficient to alter the relative position. The cost of producer gas, as given in the Table, will be enlarged on later.

Fuel	Cost per Million BTU
Retort coal gas	66 cents
Water gas	46 "
Coke oven gas	39 "
Oil gas	28 "
Producer gas	27 "
Natural gas, purchased	25 "

Cost of Producer Gas

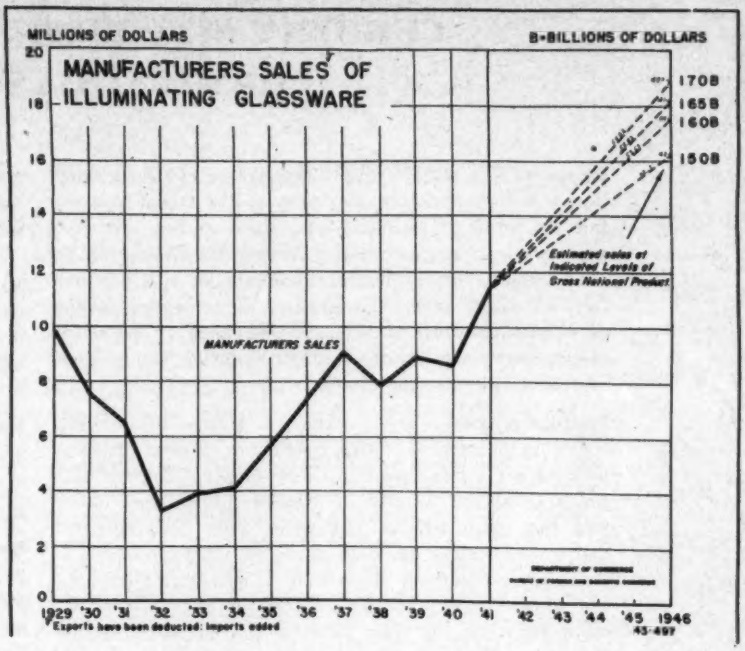
An estimate of the cost of conversion of coal to raw, uncleaned gas in a producer, will necessarily vary over a wide range, as each installation has many features which are unique. An analysis of the cost factors, which is quite typical, is that given by Windett[5] and reproduced in Table 2. Due allowance must be made for changes which have taken place since 1929, but the table will at least serve as a guide in analyzing your own costs. The figures are based on a coal cost of $5.00 a ton and this is, naturally, the largest single item.

Windett used for his calculations an installation of nine operating and one standby producer, operating 31 days a month, with an eight-hour shutdown on Sundays. As this is a considerably larger installation than most glass plants would require, labor costs and overhead charges would be considerably higher in most glass gactories.

After labor and fixed charges, steam is the next highest item in cost and this is one which will differ considerably with different installations. Glass plants as a rule buy their electrical power and have little use for

(*Continued on page* 440)

ILLUMINATING GLASSWARE MANUFACTURERS MAP POST-WAR MARKETS

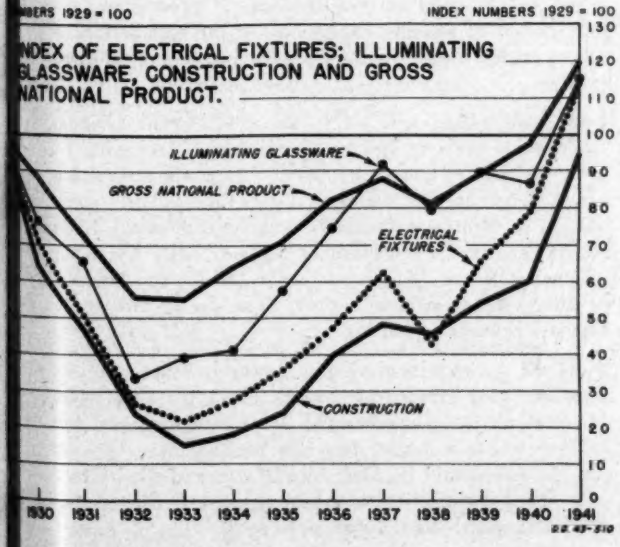

MILLIONS OF DOLLARS
B-BILLIONS OF DOLLARS
MANUFACTURERS SALES OF ILLUMINATING GLASSWARE
1708
1658
1608
1508
Estimated sales at Indicated Levels of Gross National Product
MANUFACTURERS SALES
1929 '30 '31 '32 '33 '34 '35 '36 '37 '38 '39 '40 '41 '42 '43 '44 '45 1946
Exports have been deducted; imports added
43-497

Under the auspices of the American Glassware Association about thirty-five manufacturers of illuminating glassware, bulbs and lighting-equipment met at the Biltmore Hotel in New York on September 17th to discuss preliminary plans for post-war planning in the lighting-industry.

The specific purpose of the conference was to establish how glass in its use in lighting fixtures could best function through the utilization of new developments resulting from research carried on during the war.

With Russell L. Test of Corning Glass Works presiding the program got under way with a broad outline of the objectives of the conference followed by a talk by Mr. Edward J. Detgen, Chief of the Specialties Unit of the Department of Commerce. Lighting fixtures and illuminating glassware are assigned to the Specialties Unit for both domestic and export trade.

Mr. Detgen discussed in a general way the basic principles involved in "Markets After the War" which is the Department's contribution to assist market analysts in setting their sites on a common goal of post-war opportunity for American business. He explained that according to the Department's calculations, if we achieve an annual gross national product of $165 billion in the post-war period (that is, full employment) sales of illuminating glassware might increase to $18 million or 58 per cent more than the 1941 volume. Using the same statistical basis, sales of light fixtures might increase to $81 million or 59 per cent more than the 1941 volume. Mr. Detgen emphasized that these projections were purely mechanical statistical procedures and were to be considered on that basis. The technological developments, increased sales of competing items, and other possible developments in the post-war period were not taken into account.


INDEX NUMBERS 1929 = 100
INDEX NUMBERS 1929 = 100
INDEX OF ELECTRICAL FIXTURES; ILLUMINATING GLASSWARE, CONSTRUCTION AND GROSS NATIONAL PRODUCT.
ILLUMINATING GLASSWARE
GROSS NATIONAL PRODUCT
ELECTRICAL FIXTURES
CONSTRUCTION
1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941
DE 43-510

Another member of the Department of Commerce to address the assembled glassmen and lighting fixture manufacturers was Mr. J. Joseph W. Palmer, Chief of the Construction Unit of the Bureau of Foreign and Domestic Commerce.

Mr. Palmer in his discussion generalized on the prospects for post-war construction based on the information that is currently available. He explained that while the resumption of activity in private construction after the war will be delayed while adequate supplies of building materials are being produced and distributed, prospects are bright for the attainment of a good, even a high, level of operations early in the post-war era. The outlook is brightest for residential building where, by 1946, the demand may reach 4½ million dwelling units. This total will include some 3 million single unit structures of which an estimated 1.8 million will cost under $5,000. The foreseeable demand also includes about a half million two-family structures with the final million units housed in structures containing 3 units or more.

Mr. Palmer stated that, according to present indica-

(*Continued on page* 434)

CURRENT SITUATION ON GLASSMAKING CHEMICALS AND SUPPLIES

Arsenic: The arsenic supply remains in a critical situation. With manpower shortages at the mines and refineries, plus delayed imports, the supplies are considerably less than estimated. Arsenic for direct military purposes and for agricultural insecticides still requires the bulk of the arsenical supplies. Every request by the glass manufacturer for arsenic is screened by WPB for essentiality and to see if substitute materials can be used or residuals containing arsenic.

Sodium nitrate: The position of sodium nitrate continues to be critical. This country is dependent upon imports for a large portion of its supply. Negotiations for a continued supply of Chilean nitrate are under way but until definite assurances have been received that transportation has been provided, it is impossible to make any estimate on the volume of anticipated imports. The glass industry has been restricted in its use of sodium nitrate in the glass batch to prevent requirements from increasing. At the present time the glass manufacturers are allowed sodium nitrate for borosilicate glasses, lead tubing, and hand operations. No sodium nitrate is allowed for use in continuous tanks and automatic forming machines. In a letter dated July 6, 1943, to all glass manufacturers, it was pointed out that, "In the case of all types of glass, in the manufacture of which sodium nitrate and potassium nitrate *are permitted*, the consumption of the materials during the current fiscal year ending June 30, 1944, may not exceed the tonnage consumed for the same types of glass during the fiscal year ending June 30, 1943." This is not to be construed as a guarantee that 100 per cent will be received. Approvals are being controlled on a quarterly basis.

Soda ash: No actual shortage of soda ash is anticipated, although it is in heavy demand. There has been no marked increase in the demand for dense soda ash except on the part of the glass industry. Stocks of dense ash are considered adequate at this time. Soda ash has been exempt from the inventory restrictions of Priorities Regulation No. 1. Although this exemption is being terminated, the action is not prompted by shortage, but rather by a desire on the part of the WPB to have stocks situated in the most flexible position.

All forms of soda ash have been short on the Pacific Coast and it has been necessary to augment the supply by shipments from Eastern sources. Sufficient expansion of soda ash facilities were provided for during 1942 on the West Coast to take care of the demand, but the producers have been unable to operate the capacity at full peak due to manpower and process difficulties. At the present time indications are that improvement is taking place.

Fiber shipping cartons are still a serious problem for the glass manufacturer. All carton manufacturers have high rated orders on hand, and the temporary ratings assigned to consumer items of glass are usually too low for the glass man to get cartons on time and without considerable shopping around on his part. Military and essential items are having trouble too in getting shipping cartons, because of manpower shortages in getting the pulp from the woods.

The ratings assigned to the glass manufacturers on appeal basis are temporary, but it is expected that in a short time a new carton order will be issued which, while it may not ease the carton situation, will permit assignment of ratings for the more essential types of glass being produced.

Fuel: The problem of fuel in the Appalachian area for the winter months is still unsolved for the users of natural gas and fuel oil. Coal is not expected to be a big problem, with the exception of transportation.

Natural gas: Increased demands for natural gas in war production plants in this area, coupled with depletion of the gas reserves, have brought about a shortage which may be serious in some sections during the winter months, December through March. Shortages of steel and other critical materials have made it impossible for gas suppliers to extend pipeline facilities to connect new sources of gas in the Southwest, but the recent approval of a new pipeline from Texas may provide some relief before the winter of 1944-45 through a more generous release of reserves.

Until such relief can be provided, however, it is necessary that all consumers conserve natural gas in every possible way in order to avoid a crisis in the gas supply during peak demands. All users will be asked to participate in a voluntary conservation program during the winter. War production plants are being asked to utilize solid fuel wherever possible and to protect vital war production with other standby fuel where practicable.

Among the large industrial users of natural gas other than steel are the glass, pottery and refractory industries. Representatives of the WPB have recently been contacting such factories and advising them of existing conditions, and to urge the rescheduling of production, rehabilitation of standby equipment, or the installation of other standby fuel to protect plants during gas shortage periods.

Coal distribution will be in the Government's hands. High grade coals in western Pennsylvania are going to the steel industry under directives. Low grade strip coals are available in this region. High grade volatile coals are not so tight and should be available after the Lake season is over. Production of all soft coals has been off due to strikes. Anthracite barley, which can be used in producers, is in good supply. The use of this grade requires a water-cooled stirer.

Fuel oil is in critical shape; however, some applications are being granted for standby use in glass factories. No firm oils are being granted, but only enough oil for holding which will not allow for production. Appeals for fuel oil should be filed on PDL-13, and filed direct with the District Director of Marketing, PAW, in the district in which the factory is located.

INVENTIONS AND INVENTORS

A Summary of Patents of Interest to the Glass Industry Issued During August

Compositions

Glass compositions having a lower expansion coefficient than fused quartz have been announced by Martin E. Nordberg of Corning Glass Works in patent 2,326,059. They are comprised of 89 to 95% silica and 5 to 11% titania. On studying the expansion characteristics of the glasses within this range it was found that when the titania content is increased to 9% the expansion coefficient becomes substantially zero. That is, a glass composed of 91% SiO_2, 9% TiO_2 does not appreciably expand nor contract when heated or cooled within the temperature range 0 to 300°C. When the titania content is increased to above 11% the expansion coefficient exceeds that of fused quartz and the glass develops other undesirable features.

Although the silica and titania in the above percentages are the only essential constituents of Nordberg's new compositions, he reports that no radical change occurs if alumina or zirconia up to about 5% are included.

Silica is cheap and titania fairly so, but unfortunately for their application these glasses are so refractory that the usual glass melting methods do not produce satisfactory results. Instead they must be prepared by such laborious and small scale procedure as by volatilizing mixtures of dissolved silicon and titanium salts in a high temperature flame which vitrifies the resulting oxides as they impinge on a collecting surface. This yields an intermediate product which needs to be vitrified by heating to about 1600°C, and to be molded and formed. At this temperature the new glass compositions are transparent but if the heating is stopped at a somewhat lower temperature they will be opal.

Furnaces

To join the growing list of patents which employ the thin blanket principle for feeding a melting tank, H. L. Halbach, W. G. Koupal and Wm. Owen of the Pittsburgh Plate Glass Co. have added 2,327,887 which is illustrated in Fig. 1. All such ideas strive for the elimination of the disadvantages of those feeders which pile the batch into the furnace in a more or less uneven heap which melts unevenly and with difficulty. A uniform feed extending entirely across the furnace gives the advantage of greater surface available for the melting down action of the flames. In a deeper pile, underlying portions of the batch would be insulated from the flames and the more intense heat and consequently a higher temperature is necessary within the melting zone.

This is one of the great gains claimed for thin blanket feeding: that the furnace temperature can be appreciably reduced and the life of the refractories extended.

In the feeders of Fig. 1 the batch materials are fed to the hopper 221, the bottom of which is a plate whose forward edge 118 is reciprocal from the illustrated position to an advanced position, and this action carries a thin layer of batch into the furnace. When the plate is returned to the position shown, the result is to leave the batch without support so that it is in consequence deposited in a layer of uniform thickness upon the molten bath.

Feeding, Forming and Shaping

A continuous machine for making tumblers and other hollow glassware is disclosed in patent 2,327,673 assigned by C. B. Shillinger of Toledo to Owens-Illinois Glass Co. The machine which is of the suction gathering type includes a rotary mold carriage (40 at left in Fig. 2), with blanks gathered from a forehearth 44, a chain type spindle conveyor carrying spindles to which the blanks are delivered directly from the blank molds, and blow molds carried on a chain type conveyor (over sprockets 54,55) which travel with the spindles while the blanks are blown therein to finished form.

Among the novel features are the means of rotating and inverting the spindles. For example as they approach the gathering zone they must be swung horizontally so as to be able to pass under the forehearth. To amplify a single detail, Fig. 3 shows a spindle 45 in process of inverting after the blank mold has deposited the blank on the spindle. This stage of inversion also shows at station 29 in Fig. 2, and occurs just before the spindle carriage comes into cooperation with the finishing mold carrier.

In patent 2,326,730 John F. and Wm. J. Kelly of Elkins, W. Va. have described a glass mold in which a nickel-iron alloy molding surface is backed and integrally bonded with much cheaper cast iron. The idea of a bimetallic mold is not new but the Kellys believe they have made a real step forward by fusing the two metals together so as to allow the most effective dissipation of heat. Their method consists in first making the mold of high nickel alloy, machining it, then heating it to 1600°F in a non-oxidizing atmosphere, and finally pouring cast iron around it. Due to the preheating of the nickel-iron alloy, the ordinary cast iron fuses with the alloy to give a good bond.

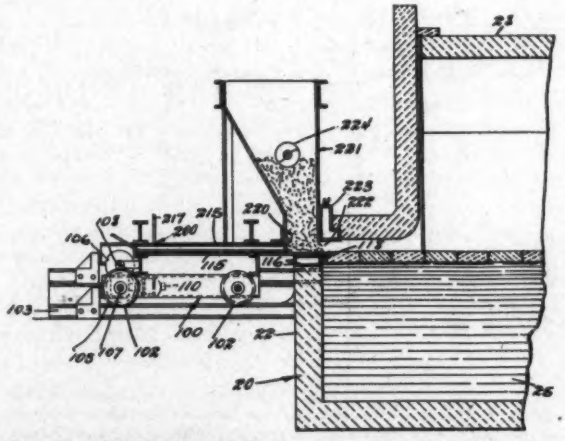


Fig. 1. 2,327,887: Halbach, Koupal and Owen. The reciprocal movement of the feeder plate 118 forces the blanket of glass batch into the furnace and allows a new charge to fall onto the glass bath.

In patent 2,326,044 J. T. Littleton of Corning Glass Works describes a roll made of glass and used in forming glass sheets by the rolling process. He states the objections to rolls of metal or prior forms of ceramics and then suggests the use of glass having a silica content of over 95%. Such glasses have a softening temperature exceeding 1500°C, and a low coefficient of expansion. In the design of roll described by Littleton water cooling may be used.

Harold R. Schutz of Toledo assigned to Libbey Glass Co. his patent 2,327,825 for a machine for molding the bases of stemware and attaching them to the bowls. The machine includes a rotating work table which receives the bowls, an elevator carried by the table and a device mounted separately from the table which automatically operates the elevator to lift the bowls into the position in which the bases are molded to them. The bases are formed in press molds carried by a mold table above the work table. Fig. 4 shows one of the bowls 28 in elevated position with the pressed base being attached. (Page 442.)

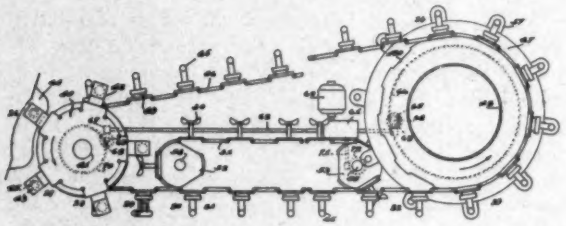
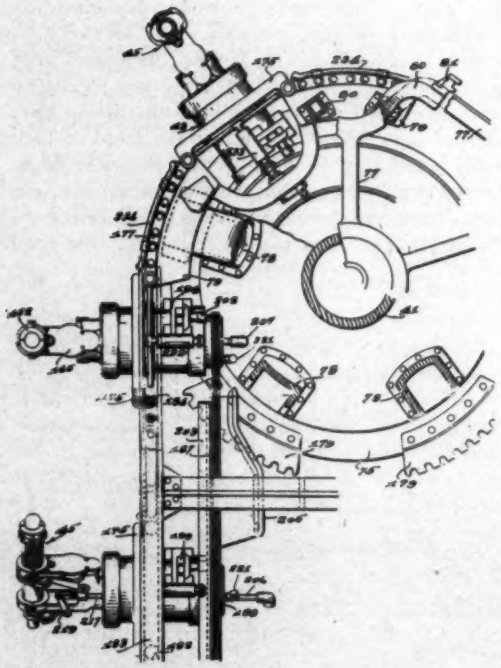


Fig. 2.



Figs. 2 and 3. 2,327,673: Schillinger. Container forming machine in which the suction drawn blanks deposited on chain driven spindles cooperate with finishing molds on a similar conveyor. The stations at which the spindles and blowing molds conjoin are shown in Fig. 2 at 30 to 45. Fig. 3 shows a spindle 45 in process of inversion after receiving the blank.

Miscellaneous Processes

Patent 2,326,009 granted to Ray C. Cobel of Newark, Ohio (A. H. Heisey & Co.) concerns designs of glass prisms suitable for chandeliers, etc., which contain molded-in sockets for ease of support.

John K. Jackson's patent 2,326,034 assigned to Corning Glass Works describes a grinding apparatus equipped with chucks designed to hold large numbers of radio tube bases to be surface ground.

Walter E. Campbell of Tarentum, Pa. (Pittsburgh Plate Glass Co.) received patent 2,327,868 for a contribution to the old art known as vitreology by which glass surfaces have been decorated by applying a film of adhesive which on heating dries and contracts to detach particles of glass by chipping from the coated surface. It is said to be difficult to control the heating and drying of the adhesive layer so that the chipping of the glass will be uniform and of equal intensity and brightness throughout. Campbell has made the discovery that the chipping will occur not only upon heating but upon chilling the glass and has directed his patent toward this modification. The glue, which may be either furniture makers' glue or a cold adhesive is first applied in the desired pattern and in varied thickness if variation in thickness of chipping is desired. (Close contact of glue to glass is essential and may require a preliminary sand blasting.) Then the article is placed in a refrigerator where the reduction in temperature and moisture dry the glue and result in chipping.

In patent 2,328,533 assigned to AlnCin Inc., Buffalo, by Victor Walker of Ontario, Canada, an acid treatment is described for removal of the surface of lens blanks which require such final reduction as might normally be accomplished by grinding and polishing. Walker's machine holds the blank in a spindle which oscillates and rotates it against a flexible rubber sheet immersed in a bath of hydrofluoric acid or other solvent. The sheet conforms to the shape of the lens and continually rubs it. It is grooved so that an acid supply will always be kept in contact with the lens.

Clarence Birdseye and Pincus Deren have assigned to Birdseye Electric Corp. of Gloucester, Mass. their patent 2,327,978 for processes of making reflecting electric lamps in which the light source is hooded by a reflecting surface formed upon a portion of the bulb. They apply a frosting solution to the inner surface of the bulb and then use a so called stripping solution of 25% hydrofluoric acid to which 5% of ammonium bifluoride is added. This strips the frost in such a manner as to give depressions which when viewed with ample magnification might be described as shell-like. Next the process provides for the application of the metallic reflecting coating and finally its removal from portions of the bulb which are to transmit light.

Sheet and Plate Glass

Fig. 5 (Page 443) shows the suggestion made by Gerald White of Libbey-Owens-Ford Glass Co. in patent 2,328,404 for a means of preventing the deformation of the edges of tempered glass sheets by the tongs which

(*Continued on page* 442)

Research Digest

Practical Interpretations of Glass Technology

The Effect of Arsenic on the Melting and Refining Rate in a Tank Furnace of Soda-Lime-Silican Glass for Colorless Containers

Although systematic investigations carried out many years ago on glasses melted in pots showed that arsenic, when mixed with a batch composed of sand, soda ash, and limestone, does not assist melting and refining it is still stated by some that in tank furnace melting arsenic does influence these factors and that its absence will result in an increase in fuel consumption.

F. Winks (Journal Society Glass Technology, February, 1943) has recently reported on the results of a large scale investigation on the influence of arsenic on glass melting and refining under commercial conditions with particular emphasis on the possible increase in fuel consumption.

A simple soda-lime-silica glass was melted in a tank furnace during commercial production and fuel consumption data taken both before and after removing the arsenic and declorizer mixture from the batch. From the data collected it was concluded that: 1. No increase in fuel consumption occurred when arsenic and decolorizer were eliminated from the batch. 2. No difficulties or defects arose either during melting operations or during the working of the glass by the machines, when arsenic and decolorizers were removed. 3. At the iron oxide level (maintained at 0.06 per cent) the glass had a greenish color which was by no means pronounced, while its brilliance was greater than was the case when decolorizers were present. (These conclusions, arrived at from experiments carried out under controlled conditions, concur with the practical observations of many American glass furnace operators who have been melting glass for the past year or so without the use of arsenic or other chemical decolorizers.

Determination of Alkalies in Glass

In the A.S.T.M. standard method for the Chemical Analysis of Soda-Lime Glass (C 169-41T) the use of ethyl alcohol in the preparation of wash solutions in the procedures for determining sodium and potassium is recommended. Due to the present difficulty of obtaining 95 per cent grain alcohol and its high cost, P. A. Webster and A. K. Lyle (Ind. Eng. Chem., Anal. Edn., 1943, 15, 36) have investigated the possibility of using one of the specially denatured alcohols as a substitute. Two commercial denatured alcohols were selected for trial, one containing about 10 per cent of ethyl ether and the other about 10 per cent of acetone. Both were found to be satisfactory substitutes for the grain alcohol. It was also mentioned that recent work by other investigators has shown that undiluted 95 per cent alcohol is a little more satisfactory than the diluted form as a wash solution for potassium chloroplatinate.

The Influence of Sodium Chloride on the Iron Oxide Content of Molten Soda-Lime-Silica Glasses

The present lack of decolorizing chemicals and the desire to maintain their previous quality levels has led many manufacturers of flint glasses to investigate various schemes for decreasing the iron content of their flint glasses, the viewpoint being that as iron is the chief cause of color in flint glasses any decrease in the amount of iron present in the glass will help to improve the final color or lack of color obtained. Among the numerous schemes that have been advocated during the years, one in particular, namely the removal of iron from the glass as a volatile compound, has been given serious consideration at various times. This scheme has its theoretical basis in the fact that the chlorides of many elements, including metals, are so stable that they can be melted and volatilized unchanged. As the chloride of iron has a relatively low boiling point attempts have therefore been made to convert the iron present in the glass (while molten) from the oxide form to the chloride form. The iron chloride is lost by volatilization which results in the elimination of the iron from the glass.

How successfully the removal of iron in this manner can be accomplished (at least as far as small scale meltings are concerned) has been fairly recently investigated by Bateson and Turner (Journal Society Glass Technology, 1939, 23, 253) and by Halle and Turner (Journal Society Glass Technology, 1940, 24, 41).

In the investigation by Bateson and Turner, meetings were made at 1400°C, in platinum, of a glass of the composition SiO_2 75.0, CaO 9.2, Na_2O 15.8 per cent, to which either 0.1 or 0.2 per cent of iron oxide as Fe_2O_3 in the glass was added and the batch melted with addition of one of the chlorides, ferric chloride, sodium, potassium, or ammonium chloride, in amounts equivalent in terms of chloride, to 0.1, 0.2, or 0.4 per cent of the glass. The results obtained showed that during the process of melting the presence of chloride in the batch does lead to the removal of a fraction of the iron present probably in the form of chlorides. The extent of the elimination of iron oxide was variable in the most favorable case (presence of ammonium chloride) it did not quite reach 25 per cent. In the case of sodium chloride, the substance which would normally be preferred (for example, as an added and desired impurity in the soda ash) if it could be shown to be of value, the amount of iron oxide eliminated in no case reached 10 per cent of the amount initially present. While the use of ammonium chloride was the most effective its use is not recommended due to its tendency to cause discoloration (yellowish-brown tints) of the glass.

In the later investigation by Halle and Turner, glasses of the composition SiO_2 73.5, CaO 10.0, Na_2O 16.5 per cent and containing only 0.08 per cent Fe_2O_3, were melted in platinum at 1500°C both with and without the addition of sodium chloride and other volatile materials. The amount of sodium chloride added in all cases was equivalent to 0.2 per cent chloride in the glass. The other volatile materials added with the sodium chloride and then amounts in the different series were: (a) selenium 0.4 oz. per 1000 et. of sand, with cobalt oxide, in amount

(*Continued on page* 438)

CURRENT STATISTICAL POSITION OF GLASS

During July activity in the glass industry continued at the same level with production, employment and payrolls still maintaining a higher level than the previous year. According to the July Production Index output totalled $44,000,000 as compared to $36,000,000 in July, 1942. This brought the seven months cumulative total to $301,000,000 or a 5 per cent increase over last year's corresponding total.

Plate glass production during August totalled 6,993,-521 square feet, according to the Plate Glass Manufacturers of America. This represented an increase of 9 per cent over the previous month and 78 per cent more than the total for August 1942. The total production during the first eight months of 1943 was 45,572,342 square feet or 6 per cent more than last year's corresponding period.

Window glass production for the month of August was 1,296,055 boxes which represented 79.8 per cent of the industry's rated capacity. As compared with this, production for August 1942 was 1,075,343 boxes or 66.2 per cent of capacity. The cumulative total for the January-August period was reported at 8,946,724 boxes or a 21 per cent decline from the same period in 1942.

Glass container production during August amounted to 8,272,137 gross, highest in the history of the industry, according to the Glass Container Association of America. This represented an increase of 25 per cent over August 1942 and 7 per cent over last month's total. During the first eight months of 1943 a total production of 61,049,-396 gross was established, a 16 per cent increase over last year's comparable period.

Shipments of glass containers during August totalled 7,996,816 gross, showing an increase of 15 per cent over August 1942 and a slight increase over last month. The outstanding gains over 1942's corresponding month were: general purpose ware—up 108 per cent; pressed food ware—up 71 per cent; medicinal and toilet ware—up 59 per cent; narrow neck food containers—up 35 per cent; pressure and non-pressure ware—up 26 per cent; and wide mouth food bottles and jars—up 22 per cent. A decrease was reported in beer bottles, down 46 per cent; liquor ware, down 40 per cent; and domestic jelly glasses, down 28 per cent.

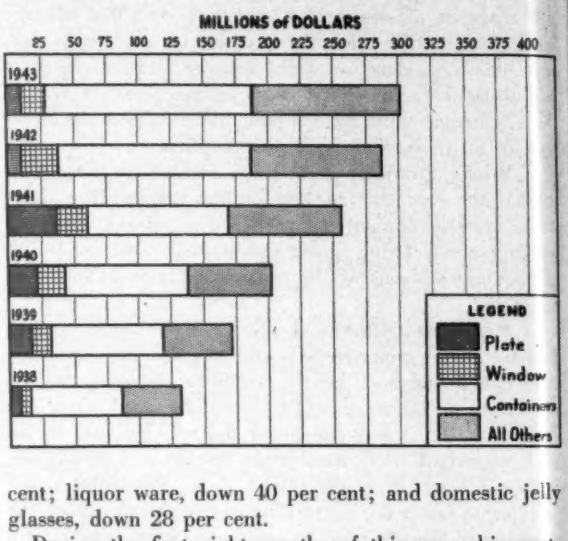
During the first eight months of this year shipments increased 19 per cent over last year to 62,825,961 gross. Domestic fruit jars led the increases with 144 per cent; general purpose ware increased 55 per cent; narrow neck food containers, 34 per cent; and wide mouth food bottles and jars, 38 per cent. Liquor ware decreased 17 per cent; beer bottles, 8 per cent; milk bottles, 7 per cent; and pressed food ware, 5 per cent.

Inventories of glass containers in the hands of manufacturers at the end of August totalled 5,022,225 gross, or a decrease of 45 per cent from last year's total for the same period. Stocks of all types of ware showed large decreases from last year's figures.

Automatic tumbler production during August amounted to 5,090,053 dozens, a 13 per cent increase over last year's corresponding figure. During the first eight months of this year this output amounted to 36,-

THE GLASS INDUSTRY'S INDEX

Production: Seven Months, January Through July



CURRENT GLASS CONTAINER PRODUCTION

(ALL FIGURES ARE GROSS)

	Production		Shipments		Stocks	
	Aug. 1943	*Aug. 1942*	*Aug. 1943*	*Aug. 1942*	*Aug. 1943*	*Aug. 1942*
Food Containers (Narrow Neck, Wide Mouth and Pressed Ware)	3,123,414	2,499,072	3,008,564	2,416,113	1,525,814	2,582,586
Pressure and Non-Pressure Ware	451,306	294,362	448,615	320,206	274,613	353,442
Beer Bottles	520,098	676,152	416,295	737,603	188,834	345,475
Liquor Ware	762,564	1,178,306	738,140	1,164,388	570,913	1,453,248
Medicine and Toilet Ware	2,062,067	1,178,653	1,979,048	1,252,682	1,746,720	3,142,799
General Purpose Ware	659,293	293,348	682,617	329,396	343,922	567,812
Milk Bottles	271,912	285,558	280,627	270,169	308,043	363,276
Fruit and Jelly Jars	386,716	174,343	406,461	400,656	37,509	293,342
All Other	34,767	28,906	36,449	30,012	25,857	36,569
Total Industry	8,272,137	6,608,700	7,996,816	6,921,225	5,022,225	9,138,549

545,267 dozens, a slight increase over 1942's total. Shipments of automatic tumblers during August totalled 4,775,473 dozens or a 4 per cent increase over last year's comparable total. Total shipments from January to August of 1943 were reported to be 37,377,330 dozens or approximately 7 per cent over the total reported for 1942. Stocks on hand at the end of August amounted to 6,467,272 dozens.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware were reported at 2,364,766 dozens for August, 22 per cent under last year's figure.

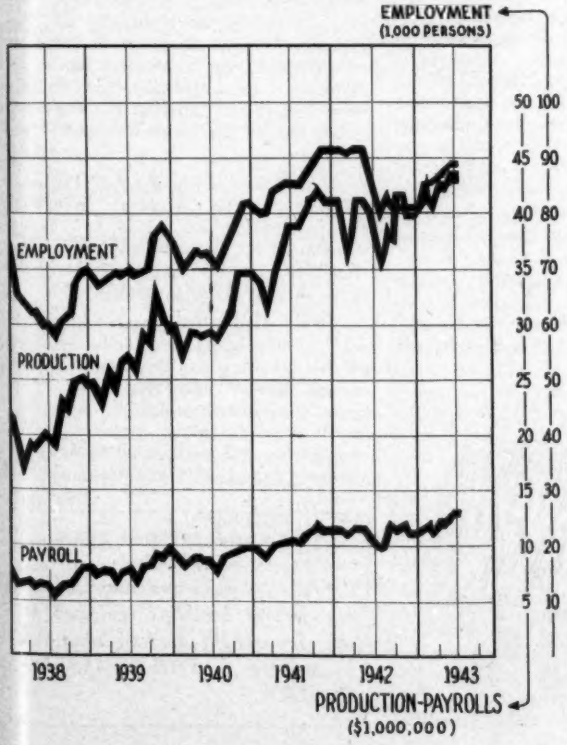
Miscellaneous glass products manufactured in July are estimated at $16,000,000. This figure was the same as last month. During the first seven months of 1943 miscellaneous glass products amounted to $112,000,000 as compared to $121,000,000 last year.

Employment and Payrolls: Employment in the glass industry during July amounted to 88,500 persons, the same number reported for last month. This figure compared with 81,000 persons employed during July of last year.

Payrolls in July were estimated at $13,000,000 the same figure reported for June but an increase over last year's figure of $11,500,000. During the first seven months of 1943 glass manufacturers paid out about $99,500,000.

GI THE GLASS INDUSTRY'S INDEX

Monthly Trends Through July, 1943



Use of Natural Gas restricted and NATIONAL AIROIL has the answer Oil Burners

DO THIS

Act now . . . don't wait until winter and risk shut-down or a frozen tank because of fuel failure.

First . . . Investigate an available source of fuel oil.

Then . . . Write us . . . Give us full details regarding your glass tank furnace.

Because . . . National Airoil Type SAL Glass Tank Fuel Oil Burner can be quickly and economically installed for emergency standby service or for regular operation.

The National Airoil Type SAL Glass Tank Fuel Oil Burner provides a flame of high velocity, intense luminosity with economy of operation.

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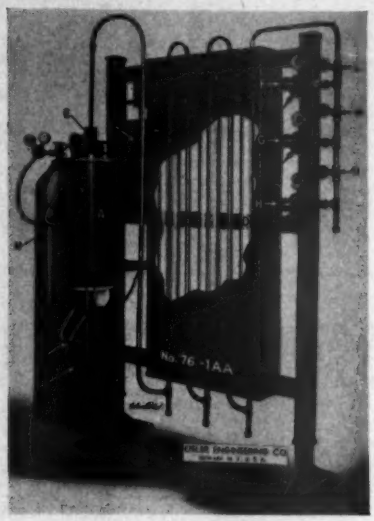
OIL BURNERS . GAS BURNERS . GAS PILOTS . PUMP SETS . EXPLOSION DOORS . ACCESS DOORS . AIR DOORS . BURNER BLOCKS . FURNACE OBSERVATION WINDOWS

NEW EQUIPMENT AND SUPPLIES

HYDROGEN GAS PURIFIER MANUFACTURED BY EISLER



To remove residual oxygen, moisture, and other active contaminating gases from commercial hydrogen the Eisler Engineering Company of Newark is manufacturing and marketing an electric Hydrogen Gas Purifying Equipment. It is used to prevent oxidation in steel-heating furnaces, to reduce all metallic parts in the production of Electronic Tubes and to weld or braze metals in an atmosphere of pure hydrogen and also for hydrogenation in various food industries.

The Hydrogen gas, to be purified under a pressure of 30 to 50 lb. per square inch, passes first through an electrically heated furnace A, which holds a calorized seamless steel tube E, containing small pieces of pure copper for removing oxygen. Then the gas moves progressively through three glass containers B, C and D filled with purifying ingredients such as caustic potash or sodium lime. From the last glass tube D, the purified gas enters a manifold with three outlets L, M and O leading to three different supply lines, from where it may be directed to small furnaces or other places where purified Hydrogen is required.

Hydrogen Gas Purifiers are manufactured in different sizes depending on the amount of gas required.

LEEDS & NORTHRUP HAS NEW PORTABLE INDICATOR

To measure pH conveniently, quickly and accurately, Leeds & Northrup company has produced a new and improved portable universal pH indicator which, direct reading with glass, hydrogen and quinhydrone electrodes, combines the same sound measuring principle and durable qualities of its predecessor with the following added advantages: (1) self-contained electrodes of new and improved design; (2) in addition to the standard 50 ml sample beaker, a small volume holder for samples of approximately 2 ml; (3) a reduction in the number of knobs and switches used in standardizing and measuring; (4) a polarity reversing switch for the volt range.

Conveniently packed in a light weight carrying case, it is said to be easily accessible because of the quickly removable lid. The company has also issued a catalog describing this new indicator.

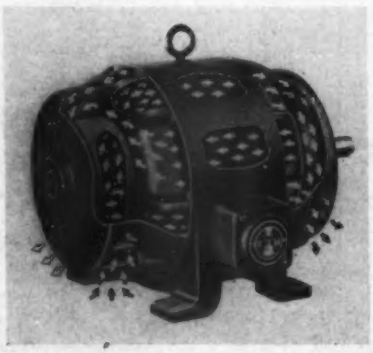
NEW ALL-PURPOSE MOTOR HAS MANY SPECIAL FEATURES

For use in all kinds of industry, Fairbanks-Morse has announced a new type, all-purpose, continuous-duty, Polyphase Squirrel-Cage Induction Motor. This new motor is "protectioneered" and according to the company, embodies many special and vital features that will be viewed with extreme interest by motor users everywhere.

Constructed with the widely recognized and exclusive centrifugally-cast F-M Copperspun Rotor, this new motor is fully protected against flying chips, falling particles, dripping liquids, and other industrial motor hazards. The ball bearings sealed in cartridge-type housings minimize expensive shutdowns due to bearing failures. Cross-flow ventilation is obtained through protected inlets and exhausts at each end of the motor—resulting in uniform cooling and the elimination of hot spots.

Regardless of the position of the motor, complete safety for the operator is assured because there are no moving external parts. The frame is cast in one piece with rib sections to give added strength without increase in weight.

The new motor also incorporates an innovation in conduit boxes. Where space is limited, the conduit can be brought up between the motor feet to the tapped hole in the motor frame and the conduit box cover assembled flush with the frame.



PAYROLL CALCULATOR SIMPLIFIES FIGURING

Overtime, as well as straight time payroll calculations, can be figured quickly with a new and improved model payroll calculator now being manufactured by the Berger-Brickner Company of Los Angeles.

Forty hours plus overtime are calculated in one operation on one side of the device for firms that require total pay check only. The reverse side is used for figuring straight time and overtime as separate items.

All hourly rates of pay from 40 cents to $1.74 with a half cent spread between rates, and time periods up to 80 hours with divisions of tenths and quarters of an hour, are covered by the new model calculator.

CATALOGS RECEIVED

National Airoil Burner Co., Inc., Philadelphia, Pa. The latest edition of Bulletin No. 21 describing the applications of the oil burners produced by this company has just been issued. This bulletin refers to their Type SA Oil Burner which uses either steam or compressed air for atomizing the oil.

General Electric Company, Schenectady, N. Y. "Electric Furnaces," a new booklet released by General Electric, shows the major applications of their electric furnaces in many industries.

The Youngstown Miller Company, Sandusky, Ohio. A new illustrated folder describing their A and GH lines of Lubricating and Hydraulic Oil Reclaimers is now ready for distribution to anyone having a problem in oil reclaiming. In addition to the models described in this bulletin, the company builds larger machines for special requirements.

Joshua Hendy Iron Works, Pomona, California. The Westco Industrial Pumps Catalog No. 43 is now being distributed by this company and is designed to give the complete story about each of their Westco pumps.

The Felt Association, Inc., New York, N. Y. A new booklet that tells the story of the manufacture and some of the myriad uses of wool felt called "Felt Facts" has just been issued. Attention is called to its many applications in engineering and mechanical fields as an alternate for priority materials.

CATALOG & BULLETIN SERVICE

Current catalogs and manufacturers' service bulletins reviewed in this department may be obtained by writing to THE GLASS INDUSTRY.

GLASS DIVISION . . .

(*Continued from page* 423)

duce cords of lower surface tensions by incorporating such oxides in the refractory material.

Experiments were described in which vanadium and chromium were used to lower the surface tension. The results indicated the desirability of such additions. The use of lead oxide was then investigated as it does not possess the objectionable coloring power of chrome and vanadium. A series of refractory bodies containing lead oxide were made up and various properties of the resulting refractories were measured. In general it was found that with 6 per cent PbO in the refractory, its corrosion resistance was increased, its mullite development was greater, no appreciable differences were found in the behavior under load at working temperatures up to 1450°C and the apparent porosity and bulk specific gravity were not materially changed. Gathering rings have been made using 5 per cent lead oxide and are being used in plant tests. Present indications are that the life of these rings is longer, less corrosion has been experienced and less cord has resulted when compared with the use of ordinary clay rings.

(Editor's Note: The complete paper will appear in an early issue of THE GLASS INDUSTRY.)

Glass Tank Regenerator Refractories. *By C. A. Brashares, Harbison-Walker Refractories Co.*

As the extremely wide range in the types of refractories used in glass tank regenerators is particularly interesting in view of the more or less fixed theories of the properties which are most important in a checker brick the author described the advantages and disadvantages of the various types of refractories which have or are being used in glass tank checkers.

Silica brick: The high silica content of this material would seem to indicate that its utility as a checker brick would be limited. However, it is being successfully used in the checkers of tanks melting boro-silicate glasses. Its high mechanical strength at operating temperatures and its high thermal conductivity are advantageous. As silica brick are gradually and rather uniformly consumed in glass tank checkers, this property may at times be a very important consideration.

High heat duty fireclay brick: This class of refractory is the most widely used regenerator refractory. In the case of severe operating conditions its use is limited to the lower courses. In general, high refractoriness, high censity, low porosity and volume stability at high temperatures are desirable properties and are obtained by hard burning de-aired clays.

Super-duty fireclay: Both "super-duty" and "double burned" fireclay refractories are marked by their low porosity and high alumina content (compared with high heat duty fireclay brick) and find use in the upper courses of the checkers.

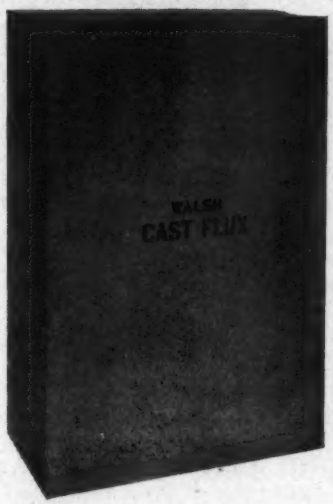
High alumina refractories: This class of refractories include those containing 50 per cent or over of alumina. The 50 per cent alumina brick are marked for their high refractoriness, chemical composition and their strength and stability at high temperatures. Their porosity is higher than super duty fire brick. The 60 per cent alumina brick have a higher refractoriness. Brick containing 70 and 80 per cent alumina have been tried as checker material but have been found to crack and shell off in service.

Special refractories containing corundum of the 60 per cent and 90 per cent alumina classes have been found to be useful. The refractoriness is high, have a high thermal conductivity, and an excellent load resistance. Their weight is great and the corundum present is extremely resistant to attack by alkaline dusts. As there is not the alumina present to form any large amounts of additional corundum volume, changes are small.

Magnesite refractories: Both hard burned and chemically bonded magnesite refractories have been used. Their basic

(*Continued on page* 435)

WALSH CAST-FLUX



The Vacuum-cast flux block of superior quality.

Walsh Cast-Flux blocks are machine-trued to exact size and shape after burning.

THEY LAST LONGER

The excellent results obtained in numerous tanks melting various types of glass has definitely established the efficiency and economy of Walsh Cast-Flux blocks.

Walsh Cast-Flux has a dense, uniform structure; it is burned at higher temperatures, is thoroughly bonded and possesses a low coefficient of expansion.

Walsh Cast-Flux blocks meet the most rigid requirements for tanks operating at higher temperatures . . . they insure greater tonnage, higher quality glass, freedom from defects, longer life and maximum economy.

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GLASS INSPECTION
with the *Polaroid*

Spectacle type polariscope

THE polarizing spectacle, mounted in unit with sensitive tint plate of 565 millimicrons, presents an absolutely uniform field of large aperture, strains showing up in sharply defined and correct colors.

Standard size apertures are 6" diameter and 12" diameter; but any special size to meet your requirement can be made. They are all light in weight and a leather case can be furnished where required. The 6" unit is suggested for either plant inspection uses or—as a portable unit for the trouble shooter or the salesman where a large aperture, compact unit of light weight is desirable.

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and
BORIC ACID
99½-100% PURE

NITRATE OF POTASH
CAUSTIC SODA
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420 Lexington Avenue, New York, N. Y. 624 California Street, San Francisco, Cal.
444 Lake Shore Drive, Chicago, Illinois 550 South Flower Street, Los Angeles, Cal.

ILLUMINATING GLASSWARE . . .
(*Continued from page* 425)

tions, residential building will not be confined to the erection of new dwellings. Conversion—of outmoded residences and of structures not previously used for dwelling purposes—may be widely practiced and offer, therefore, one practical solution to the problem posed by the blighted central areas of every large city. Similarly—the repair and maintenance of dwellings—delayed by shortages of labor and materials during the war—will probably engage the attention of many building contractors and require much building material before the nation's housing plant is once more put in good condition.

In the non-residential field prospects are brighter for commercial building than for industrial, according to Mr. Palmer, the immediate future of which is rendered uncertain by the large number of plants constructed to house war industries. The volume, location and character of industrial building undertaken after the war will be largely determined by the extent to which these war plants are susceptible of and actually are converted to the needs of peace-time industry. Public utility construction was the best sustained of all groups in the private construction field through 1942. In consequence, it is to be expected that post-war activity in this field will substantially reflect this war-time building.

Mr. Palmer pointed out that farm construction, seriously impeded during the war by the difficulty of obtaining material, may constitute a sizeable post-war backlog the actual extent of which will largely be determined by the size and character of the post-war market for agricultural products and the need for and availability of farm machinery to replace that worn out during the war period.

In addition to these talks by the government representatives four other papers were presented by various members of the Illuminating Glassware Section of the American Glassware Association. The papers were as follows: "Adaptation of Fluorescent Bulbs and Incandescent Light Sources to Home Lighting," by E. W. Commery, General Electric Company; "Promotion of Post-War Planning" by H. E. Plishker, Westinghouse Electric and Manufacturing Co.; "What the Glassware and Fixture Manufacturers Can Do To Make The Best Use of These New Light Sources," by Rene Maurette, Chief Product Engineer, Miralume Division, Sylvania Electric Products; and "Design Trends After the War," Members from the staff of Raymond Loewy, Industrial Designer.

Following the presentation of the various papers an open forum was held for discussion of the subjects presented at the meeting and consideration of any other pertinent matters relating to lighting.

At the close of the meeting it was resolved that a joint committee of glass manufacturers and lighting fixture manufacturers should be formed for the study and furtherance of post-war planning in the lighting industry. The objectives of the committee will be the development of plans for the utilization of existing and new materials used in lighting; to promote the interests of better lighting in new buildings and modernization of older homes. Also on the joint committee's program

of activities will be the study of conversion of many existing wartime structures. It is felt that many war plants can be converted into apartment houses or office buildings. Another focal point in the Committee's planning will be the furtherance of the rehabilitation of "blighted" areas in certain cities. Those cities where there are large areas of run down tenement houses comprising virtually slum districts. Part of the plan in this rehabilitation idea is the working out of an arrangement with city administrations whereby taxes on new replacement dwellings erected would remain at the same level for a period of years as those prevailing on the present properties.

The plans and apparent potential market for glass in the illuminating field when brought to fruition should add millions of dollars to the glass industry's total volume in the post-war era.

GLASS DIVISION . . .

(*Continued from page* 433)

properties, high weight and thermal conductivity are very suitable properties. The hard burned brick have a high thermal spalling tendency. While the chemically bonded brick have a greater resistance to spalling, they show some diminution in mechanical strength in certain temperature ranges and have a low strength under load at high temperatures. The greatest advantages of these bricks are their ability to keep free of dusts and deposits and thus very materially retard clogging.

Fosterite refractories: These refractories are characterized by their extremely high strength under load at high temperatures, basic composition, and high refractoriness. Being hard burned fosterite brick do not exhibit any diminution of strength in intermediate temperature ranges. Their resistance to deterioration by carbon monoxide may make them useful for gas checkers.

Chrome refractories: High temperature cements containing chrome have been successfully used for regenerator walls. Some attempts have been made on the use of chrome brick in the checker construction but as yet the results are not conclusive.

HOLDER ELECTED TO HEAD WICKWIRE SPENCER STEEL COMPANY

Mr. E. Perry Holder, former president of the Vulcan Iron Works, has been elected president of the Wickwire Spencer Steel Company, succeeding E. C. Bowers, president of the company since 1926. Mr. Bowers has resigned because of serious illness but will continue on the Board of Directors and Executive Committee.

Mr. Holder is a graduate of Yale College with the class of 1918 and served in the army during the last war. He has held executive positions connected with the manufacture and sale of steel and other metal products almost all of his business career. During the N.R.A. he served on advisory boards of three industrial organizations. He was executive vice-president of American Machine and Metals, Inc., until 1937 and since 1940 has been president of the Vulcan Iron Works of Wilkes-Barre.

• Users of natural gas in the Appalachian area after September 30, 1943, who used more than 100 thousand cubic feet in any day for heating a boiler during the twelve month period preceding August 26, 1943, will be prohibited from receiving delivery according to WPB Directive 2, Order L-31.

A Few Colors are Out for the Duration—

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CERAMIC COLORS ARE STILL AVAILABLE—and New Ones are Still Coming In . . .

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OWENS-CORNING OPENS DISTRIBUTION CENTER AT BURLINGTON

Owens-Corning Fiberglas Corporation has announced the formation of a central servicing, quality control and distribution point at Burlington, New Jersey, in order to speed shipment of critical glass fiber yarns and fabrics to war contractors. R. R. Pryor of Toledo will be the manager of the Burlington distribution center. He has been associated with Owens-Corning for the last six years.

The new center will be located in a building formerly occupied by the Burlington Silk Mill. Here will be centralized all servicing of outside manufacturers and customers formerly handled by the Toledo general offices and the factories in Newark, Ohio, and Ashton, Rhode Island. Except for key personnel transferred from the company's general offices and factories, all employees will be recruited from among residents of Burlington and vicinity.

Glass fiber textiles are used in plane construction; in shipboard, air-borne and automotive electrical equipment; and for reconnaissance flare shades. Classed as a critical material, they are supplied only under allocation in accordance with WPB conservation order M-282.

Other officers transferred to the Burlington staff are: J. P. Mathias, throwing supervisor, and W. H. Jenkins, Jr., accounting and budget supervisor, both from Toledo; R. C. Burgess, service manager, and Louis P. Savarie, product control supervisor, from Newark, Ohio, factories; H. E. Mahler from Ashton, Rhode Island, plant will be weaving and processing supervisor.

The center opened on October 1 and full scale operation is expected by early November. No manufacturing operations are contemplated.

PENNSYLVANIA SALT ANNOUNCES CHANGES IN CENTRAL OFFICE

The Manufacturing and Engineering staffs at the Central Office of the Pennsylvania Salt Manufacturing Company of Philadelphia have announced a reorganization due to the expansion of the Company's manufacturing activities.

Walker Penfield, formerly Manager of Engineering, has been appointed Works Manager and will be in charge of all the manufacturing activities of the Company and all of its subsidiaries except the Pennsylvania Salt Manufacturing Company of Washington. William F. Mitchell, formerly assistant to Mr. Penfield, continues in that capacity with the title of Assistant to the Works Manager.

Floyd H. Walker, formerly Chief Engineer of Swenson Division of the Whiting Corporation, is appointed Chief Engineer and will be in charge of the Central Engineering Division. He will have charge of new construction and assist the Manufacturing and other departments in engineering matters.

A. E. Gaydos, formerly in charge of the Central Engineering Division under Mr. Penfield, has been named assistant to the Vice President in charge of Manufacturing, assigned to special duties.

Vincent K. O'Connor, formerly with the Tacoma, Washington Office, has been appointed Manager of the newly created Personnel Department in charge of the handling of all personnel matters and labor relations.

GLASS IN THE WAR AND B_2O_3

In this war of materials, glass is playing a tremendously important part. Many kinds of glass are directly or indirectly aiding the over-all effort. From the lowly bottle or jar to the finest precision bomb-sight lens, glass is filling requirements that no other product can meet. Not all glass contains Borax or Boric Acid but in some glasses these products are absolutely essential, depending upon the specific use for which the glass is intended. Twenty-Mule-Team Borax and Boric Acid is directly contributing to the war effort where these materials are essential batch ingredients. Those manufacturers who are not now using Borax will find definite advantages in quality of product and manufacturing operations by inclusion of Borax in the batch formula.

PACIFIC COAST BORAX COMPANY

DEPARTMENT G • 51 MADISON AVENUE • NEW YORK

(*Continued from page* 429)

appropriate to decolorize the iron oxide, (b) borax, to yield 2.0 per cent in the glass, (c) ammonium sulphate, 7.5 parts per 1000 of sand. Then results are summarized in Table I and they agree very well with those obtained by Bateson and Turner with the exception that when selenium is present with the chloride, the loss of iron oxide is slightly increased, but in no case is the removal of iron oxide great enough for practical purposes. However, these experiments are small scale melts with glass having an iron content (0.08 to 0.2 per cent) much greater than is usually encountered in a good grade of flint glass. The fact that part of the iron is removed as a volatile material when chlorides are intentionally introduced into the batch is definitely proven and it is quite possible that a large scale plant test with glasses of lower iron content may show that sufficient iron can be removed in this manner to materially improve the glass color.

TABLE I

Effect of Chloride on Iron Content of Glass
(From Halle and Turner)

Glass additions	Iron content of glass % Fe_2O_3	% Fe_2O_3 of Original lost in melting Fe_2O_3
Parent glass	0.08	——
" " + 0.2% Cl	0.071	11.3 ± 2.5
" " + 0.2% Cl + 0.4 oz. Se	0.068	15.0 ± 1.8
" " + 0.2% Cl + 2.0% B_2O_3	0.066	17.5 ± 3.8
" " + 0.2% Cl + 0.55% $(NH_4)_2SO_3$	0.057	28.8 ± 2.3

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BOOK REVIEW

"MANUAL OF A.S.T.M. STANDARDS ON REFRACTORY MATERIALS"

This latest compilation of all A.S.T.M. Standards on Refractory Materials with other pertinent information and data is the fifth sponsored by A.S.T.M. Committee C-8 on Refractories. It includes new standards for air setting refractory mortars, fireclay plastic refractories both for boiler and incinerator services, methods of test for measuring the shrinkage, spalling, and workability index of fireclay plastic refractories, and a method for measuring the thermal conductivity of insulating fire brick.

Seven specifications on refractories for various types of service are given in the book. There are two classifications of materials and the remaining 16 standards give various methods of testing, some specifically for fireclay refractory brick, others for fireclay plastic refractories, some for insulating fire brick and others for various types of refractory materials. The latter includes tests to determine P.C.E., permanent linear change, cold crushing strength, warpage, porosity, true specific gravity. An important part of the book is the section giving ten industrial surveys of refractory service conditions covering:

Open-Hearth Practice, Electric Furnaces Used in Steel Manufacture, Malleable Iron Industry, Copper Industry, Lead Industry, By-Product Coke Ovens, Lime Burning Industry, Glass Industry, Portland Cement Industry, Stationary Steam Boilers.

Other data in the manual give standard samples of refractory materials for chemical analysis, and for pyrometric cone equivalent—$1.50, $1.75.

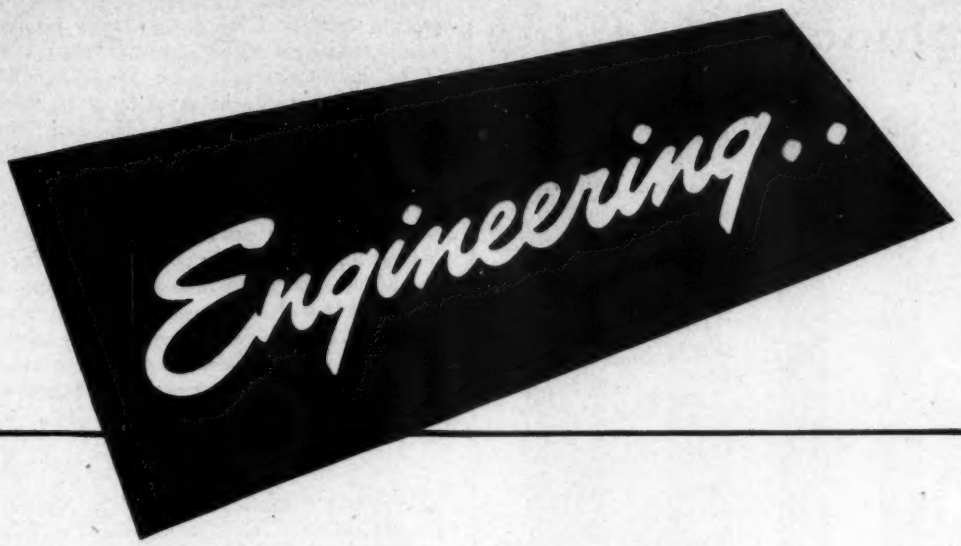
• The first meeting of the Refractories Industry Advisory Committee, composed of 24 executives of companies engaged in the production of refractory products, was held on September 17 in Washington, D. C. The membership of the committee represents the various industry groups such as fireclay refractories, silica refractories, basic refractories, special refractories, insulating refractories, and high temperature bonding mortars.

D. G. BENNETT UNDERTAKES SPECIAL RESEARCH AT UNIVERSITY OF ILLINOIS

Professor D. G. Bennett, on leave of absence from the Enamels Fellowship at Mellon Institute, has accepted a position as Special Research Professor in the Department of Ceramic Engineering at the University of Illinois.

Professor Bennett, a graduate of the Department of Ceramic Engineering at the University of Illinois, returns to the University to undertake research in connection with a cooperative arrangement between the Army Air Forces and the Engineering Experiment Station at the University. This research involves the development and study of the use of ceramic coatings on exhaust systems for airplanes. It will include both laboratory and actual service tests and a study of certain special properties of these coatings.

WHAT OF THE FUTURE OF GLASS HEATING FURNACES?



More than thirty-five years of experience go into the manufacture of every SC Lehr.

SC engineers live with heat treating. They draw on a background unusually rich . . . experience not only with glass, but with ferrous and non-ferrous metals and literally thousands of other heat applications as well.

As always in the past, SC engineering service is at the command of any plant, large or small . . . to assist in solving production difficulties . . . to develop new heat procedures . . . to apply proven principles to new processes and new applications . . . to modernize your old equipment or to design and build new lehrs and furnaces to meet tomorrow's needs. Surface Combustion, Toledo, Ohio.

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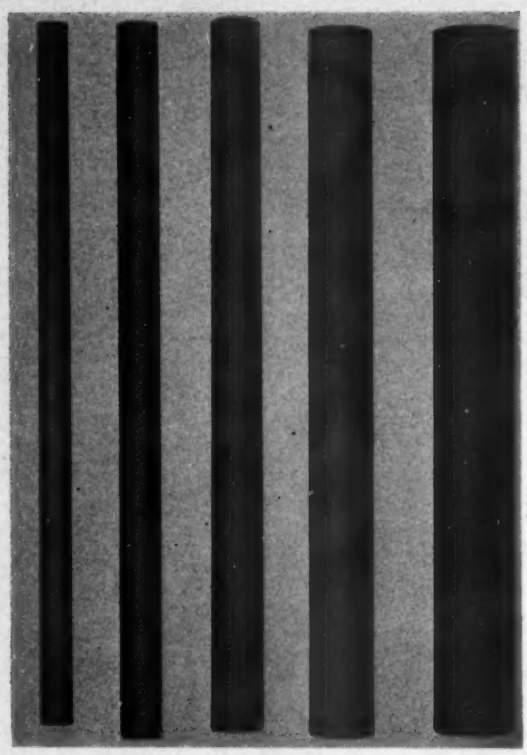
GA6

Malleable Iron Rods for plugging Moulds



3/16" 1/4" 5/16" 3/8" 1/2" 5/8" x 6"

IN the manufacture of Malleable Rods a "white iron" is produced Fe3C. The carbon is present in the combined form. The "white iron" castings are annealed or graphitized so that the final structure consists of ferrite (Fe) and free carbon (C) which is in the form of "temper" carbon.

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GAS PRODUCERS . . .

(*Continued from page 424*)

process steam, and the cost of steam for the producers will be relatively higher than for other industries.

The figures given, 27 cents per million B.T.U., apply only to raw gas. If the gas is to be freed of sulfur and tar, cleaning costs must be added, and Windett's 1939 figures[5] give these as $2.02 per ton of coal, bringing the total cost of clean gas up to 40.2 cents per million B.T.U.

However, if the producer gas is used only for glass melting and if natural gas is available for the feeders and lehrs, clean gas will not be necessary. The usual soot pockets will deliver gas sufficiently clean for tank operation, and a weekly burn-out will take care of the accumulation. Checkers must be kept clean, but any slight increase in cleaning costs will be more than offset by less frequent replacements.

TABLE II

Typical Costs of Manufacture of Producer Gas

Gas produced ..... 65 cu. ft. per lb. of coal

Calorific value, including tar vapor, 175 B.T.U. per cu. ft. or 22.75 million B.T.U./ton of coal

Based on 13,000 B.T.U. coal = 26 million B.T.U./ton

Efficiency equals $\frac{22.75}{26.00} \times 100 = 87.5$ per cent

		Cost per ton of coal
Labor		0.36
Supplies		
Steam 600 lb./ton coal	0.23	
Cooling water, 150 gal./ton	0.015	
Electric power 2 kwhr/ton coal	0.03	
Lubrication	0.01	
Total supplies		0.285
Fixed charges		
Depreciation, 10 per cent	0.16	
Tax and administration, 5%	0.22	
Total overhead		0.38
Total gasification cost		1.025
Coal		5.00
Total cost of gas		6.025
		Per million B. T. U.
Gasification cost		0.045
Coal cost		0.22
Total cost		0.265

The principal limitation of the output of a producer is the clinkering of the ash. High rates of gasification can be used with coals whose ash does not clinker readily. With easily fusible ashes, high rates can be obtained only by the use of large amounts of steam, which reduce the calorific value of the gas and decrease the efficiency.

The inherent drawback to the use of producer gas, other than the fact that the producer house has fallen down, is its low calorific value, which, translated into glasshouse terms, means low pulls. A furnace of a given size will handle only so many cubic feet of combustion product, and when it is filled up, no more can be added. With a low calorific fuel, a given furnace, therefore, will reach its limit sooner than when operating on a high heat-unit gas. This loss in production per melting unit, while it looms large in the present business picture, is not so serious as might be supposed, and it is not an unmixed evil.

Any estimate of melting performance must be predicated on the design of the furnace, the batch being melted and the selection standards which the finished product must meet. For a medium-sized tank furnace of modern design, melting a common soda-lime glass to meet the standards for commercial containers, conversion from natural gas to producer gas could be expected to result in a 15 to 20 per cent reduction in maximum pull. For example, a tank under the conditions described above, which could melt 75 tons a day with natural gas, would hardly be expected to produce more than 60 to 65 tons when operated with producer gas. A typical situation would be one where a furnace which had an average melting rate of 17 tons per 100 sq. ft.[6] with natural gas would drop to say 14 tons per 100 square feet with producer gas.

But aside from this loss of pull and the resultant effect on overhead charges which must be calculated against the ware, firing with producer gas offers no problem to the glass melter. In fact, it is a highly satisfactory fuel. Wide flames are possible, with complete and uniform flame coverage. The high luminosity causes the heat to penetrate the glass, and "cold bottoms" are almost unknown. Refractory life is greatly increased and cords are infrequent. The sudden fluctuations in pull, which are possible with natural gas, cannot be made with producer gas, so that a uniform operating rate is forced upon the plant. This may sometimes prove a trifle embarrassing to the planning department, but will greatly delight the operating department, and may result in raising the average quality of the ware.

[1]Research Engineer, Battelle Memorial Institute.

[2] "Present Status of Industrial Gas Producers," by Ralph A. Sherman. Report to Technical Advisory Board, Bituminous Coal Research, Inc., 1942.

[3] "Chemists Should Read Patents," by R. Frankl, *Ind. Eng. Chem. News, Ed.* 19, 1399 (1941).

[4] C. A. Barnes, "Possibilities in Research in Gasification of Coal"—Tec. Report No. 5 Bituminous Coal Research, Inc., 1935.

[5] Trans. A. S. M. E. vol. 51, part 2, p. 75 (1929).

[6] "Belting Performance of Tank Furnaces," Anon. *Glass Ind.* vol. 24—p. 291 (1943).

PRODUCTION OF PLATE GLASS TO RESUME AT PITTSBURGH PLATE GLASS CO.

The manufacture of plate glass will be resumed at the Creighton works of the Pittsburgh Plate Glass Company within a short time, giving employment to about 300 additional workers.

This operation was discontinued last December as a result of severe building restrictions and the ban on the manufacture of pleasure cars, two important industries normally requiring large amounts of plate glass.

Greatly increased demands of the armed forces for airplane glass has necessitated greater plate glass production. The equipment has been maintained in good order and production is expected to begin within a few weeks.

•F. W. Corkill, for thirty-five years with the Pacific Coast Borax Company, died suddenly at his home in Los Angeles on September 19. Mr. Corkill had been Mill Superintendent at Boron, California and his father was mine superintendent during the early days of the Pacific Coast Company. Surviving Mr. Corkill is a son, J. F. Corkill, who has also been associated with the company for a number of years in the New York office.

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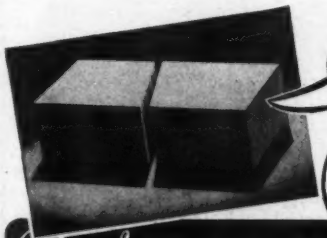

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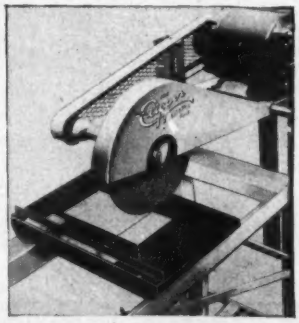

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Hays Equipment for the Ceramic Industry includes a full line of measuring, indicating and recording instruments, gages and meters, and complete systems of Automatic Combustion Control.

How these precision instruments can save time and money, materials and man-power in ceramic plants of every description, is described in Bulletin 42-552. Glad to send a copy on request—costs nothing, contains data worth a great deal.

The HAYS CORPORATION
COMBUSTION INSTRUMENTS
MICHIGAN CITY, INDIANA, U.S.A.

INVENTIONS . . .

(*Continued from page* 428)

support them vertically during the heating and chilling steps. The problem is to prevent protuberances in the upper edge of the sheet at those points which are engaged by tongs. White's idea is to provide the sheets with depressions at these points so that the vertical stretching of the sheet when soft will bring the depressed portions into substantial alignment.

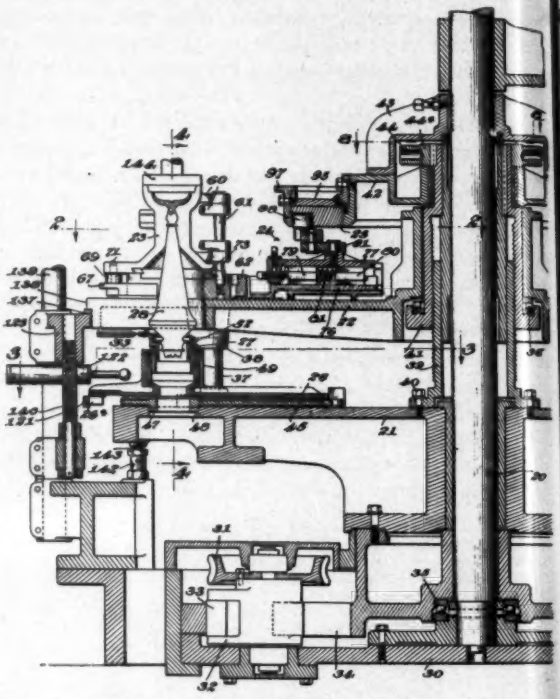

Fig. 4. 2,327,825: Schutz. Rotary machine for pressing bases onto bowls of stemware.

Another Libbey-Owens-Ford patent is 2,328,350 granted to E. H. Lindenmeyer of Toledo for sandblasting apparatus for applying stencilled designs.

Robert A. Miller of the Pittsburgh Plate Glass Co. received patent 2,327,918 for a laminated heat rejecting glass which permits vision but restricts the passage of a major portion of the total solar heat radiation. The glass has a number of layers but includes two plastic sheets which contain bands of the reflecting glass surfaces normally used in mirrors, such as silver, gold or aluminum. These reflecting bands may vary in width from about ⅛ to ½ inch, with clear spaces between them of similar width. Another patent assigned to Pittsburgh Plate Glass Co. is Henry J. Galey's 2,327,883 for a skeleton mold frame to support a glass sheet while it is subjected to heat treatment for bending.

Andrew Levaggi of Dubuque, Iowa, received patent 2,327,723 for means of using infrared lamps during mirror manufacture to aid the reaction of the mirroring solution with the sensitizer applied preliminarily to the glass surface. Patent 2,327,974 to H. M. Woelful of the Robt. Mitchell Co. of Montreal, Canada, concerns a preformed multiple glazing unit.

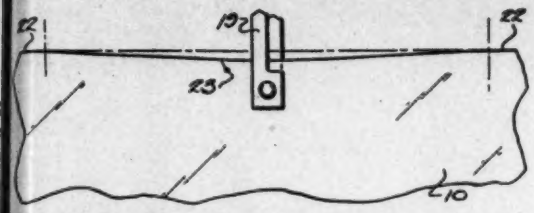

Fig. 5. 2,328,404: White. Sheets to be heated for tempering are provided with a depressed upper edge which will become properly aligned when the glass softens.

Glass Wool and Fiber

A. L. Simison of Newark, Ohio, has taken out patent 2328,302 to give the Owens-Corning Fiberglas Corp. coverage of a method of making filters from a parallel arrangement of glass fibers bound together as a faggot. In similar processes covered by earlier patents such fiber bundles with a retaining sheath were cut into filter sections which then required grinding to give even end surfaces. However the fibers break unevenly, splinter and in other ways tend to yield an irregular surface which will clog when used as a filter. Simison solves this problem by impregnating the ends of the filter sections with such a bond as Canada balsam before cutting or grinding. In this way the fibers are held solidly in place, do not tear, and can be cut smoothly. Finally the bond is removed to open the passages of the filter.

VAN DELDEN TO DIRECT INDUSTRIAL RELATIONS AT L-O-F

E. H. van Delden has been appointed Director of Industrial Relations of Libbey-Owens-Ford Glass Company, according to an announcement by D. H. Goodwillie, executive Vice President of the company.

Mr. van Delden, formerly of Allis-Chalmers in Milwaukee where he was supervisor of Industrial Relations Research, will be associated with the vice president in charge of production.

At one time Assistant Professor of Management in New York University in charge of industrial Relations courses, Mr. van Delden maintained a wide consulting practice in this field. He is at present national vice president of the Society for the Advancement of Management.

PENN SALT ASSIGNS WARREN TO CHEMICALS DIVISION

Edgar G. Warren, formerly with the General Baking Company, has been assigned by the Pennsylvania Salt Manufacturing Company to their Heavy Chemicals Division to take over the Philadelphia territory. This territory was formerly covered by Lieutenant E. M. Wilson, who has entered the military service.

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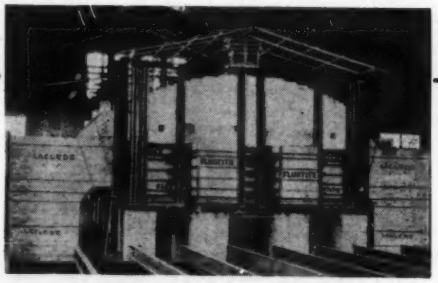
FOR THE GLASS INDUSTRY
LANCASTER, OHIO U. S. A.



Complete Installations for Bottle Plants
Complete Installations for Window Glass
Complete Installations for Tableware Plants
Glass Melting Tanks and Furnaces
Refractory Materials—All Kinds and Shapes
Blocks—Fire Bricks—Prepared Pot Clay
Automatic Forming Machines
Automatic Feeders
Automatic Glass Tubing Machines
Lehrs-Annealing and Decorating
Installations Built to Suit Conditions Abroad
* * *
IF IT IS FOR THE GLASS INDUSTRY CONSULT US
General Glass Equipment Company
ATLANTIC COUNTY TRUST BUILDING
ATLANTIC CITY, N. J., U.S.A.